



GIS Method for Mapping the Individual Education in Rajshahi City of Bangladesh

Abdul Manaf Bohari^{1*}, Md Jahan Boksh Moral²

¹Universiti Utara Malaysia, 06010 UUM Sintok, Kedah, Sintok, Kedah, 06010, Malaysia

* Corresponding Author Email: manafdr@uum.edu.my - ORCID: 0000-0002-1079-2350

² University of Rajshahi, Rajshahi, 6205, Bangladesh

Email: jahan_ges@ru.ac.bd - ORCID: 0000-0002-1079-2000

Article Info:

DOI: 10.22399/ijcesn.3491

Received : 15 August 2025

Accepted : 06 October 2025

Keywords

GIS

Education Mapping

Head of Household (HH)

Rajshahi City

Abstract:

Education is the nation's knowledge. The past decades it is increasing debate on how to better prepare school leader for their role. The work sought to examine the education mapping that is the graphical or symbolic representations of education to maps. The paper began with a momentary discussion of education level of Bangladesh. At the beginning overall education trends of Bangladesh has publicized. At last section education level of the head of the households of two case study of Rajshahi City were considered. However, education mapping of the head of households were produced. The tool GIS was used to determine their household location. A structured questionnaire was used to collect their education level data. Spatial software Arc GIS and statistical analytical software (SPSS software) were used to assemble the data. The results demonstrated that 18% of head of households (HH) have no educations and 38% completed primary education. The study identified spatial pattern of education that will contributes to make policy program of education.

1. Introduction

Education plays a crucial role in the socio-economic development of Bangladesh, influencing individual well-being, national prosperity, and global competitiveness. It is seen as a key driver for economic growth, increasing labor efficiency and productivity, and promoting social improvements like higher living standards. Furthermore, education is essential for creating a skilled workforce, addressing the demand for specialized labor in a globalized economy. According to [1] Bangladesh has confronts vexed questions as to the meaning and importance of its diverse heritage and its implications for the country's political and cultural ethos. The nation prides itself on its position at the intersection of trade routes, religious identities, and political ideologies. Bangladesh's historical roots even extend back to the prehistoric era. As a geophysical location and land formation in the world's largest delta, Bangladesh has long been an agricultural hub that attracted laborers, mercenaries, pirates, preachers, and colonial imperialists. Human development fuelled by education, one of the most indispensable variables for development, turns the

greens horns of the societies into the men of letters to improve living standard, to reduce poverty and to effectuate sustainable economic growth, is a sleeping partner of a nation's development. Despites having a deal of all hazards of the boundary of poverty, Bangladesh is very attentive to give the highest priority budget in this sector to ameliorate the quality of education at the levels of secondary, higher secondary, technical and tertiary education for mounding our county as a component of sustainable development. Poor educational attainment is conducive to create poverty along with the key supremacy on academic failure [2]. According to [3] as mentioned in Articles 15(a) and 17 of the constitution of Peoples Republic of Bangladesh have unwaveringly emphasized to ensure education for all. To improve the standards of education, education management, and formation of education policies at secondary, higher secondary, technical and vocational and at tertiary levels, the Ministry of Education (MoE 2011) has the sole responsibilities. MoE is usually doing this with utmost importance to foster the development of education sector. To acquire the overall goals of Vision 2021, Sustainable Development Goals

(SDGs) and Education for All, government and ministry are firmly determined. As a result, the government is expanding the budget for education and monitoring this sector. Education mapping is a powerful tool to identify and monitored the level of education. In 2015 Kat gall, education mapping used by R. Dade, R. Gouda, R H and Rae for the representation of semantic knowledge, is the finger's end of an experimental investigation on student learning performance, learning satisfaction and cognitive load in an elementary school social studies course which was primarily mapped [4]. The found application of concept mapping among the students is significantly increasing by leaps and bounds through web browsing. In this paper, individual by the by disaggregated education mapping has been used to eat humble pie for the poorer education level of individual. Individual mapping, the last stage of disaggregated mapping, is more imperative than aggregated mapping to fall flat for the endeavour of underdevelopment. The individual magnitude mapping, the exact personal information of the individuals in the society from top to button, gets loose the national or regional educational status given birth from the socioeconomic and homogenous characteristics of the whole area. In reasons and out of reasons, the research can help to have a great significance or contribution to eradicate illiteracy in the faces of disastrous challenges of the underdevelopment. With a view to getting the exact household information, the disaggregation, the individual household level investigation, is more applicable to eradicate illiteracy than aggregated mapping, the combined household level investigation. The household level analytical map, an important tool to improve the living standards of the urban poor, can be used by the policy makers for making their policies of education to nip in the bud of illiteracy. Educated healthy population with well trained and accomplished knowledge paves the way to tweak living standards, to consummate sustainable development and finally to change the quality of life.

2. Current Issues

Secondary education creates the bridge for ensuring the regularity or continuity of further education. Consequently, well- functioning and quality secondary education system plays as the prime supplier of quality students for subsequent educational endeavor. In Bangladesh most of the working-class people are from the secondary level. As well as many researchers have found that manpower which hour country exports to abroad is from the secondary level. So undoubtedly, semi-skilled and self-employed people are the counterpart

of good quality secondary education. It's because this huge number of secondary graduates or uncompleted graduates go into world market as semi-skilled labor. Thus, secondary education plays an utmost role to make them as human capital [4]. Therefore, mapping the individual education level is important for get more information on the current status of overall people in Bangladesh.

3. Research Question & Objective of Study

Based on the preceding assessment of the main concerns, this study provides the following research questions and research aims for reference:

Research Questions:

RQ1: What is individual education status in Bangladesh?

RQ2: What is the spatial information related to individual education in Bangladesh?

RQ3: What are the spatial data that used for mapping the individual education in Bangladesh?

RQ4: What is GIS method to be used in mapping the individual education in Bangladesh?

RQ5: How the individual education mapping will be pattern with the GIS Method?

Research Objectives:

RO1: To explore the profile of individual education and level of Household Head Completed Primary Education in Bangladesh.

RO2: To mapping the individual education by category of geographical location of Meherchandi Mouza and Keshubpur Mouza.

4. Methodology

4.1 GIS

Geographical Information System (GIS) remains a unique tool use for education mapping for a clear understanding of the nature, planning, and distribution of educational patterns and distribution as well as information related to education. All households' information gathered through field investigation on the basis of a structured questionnaire reduced the improvisation of the information and knowledge of households along with heads of the households. Educational information of the heads of households together with other information was collected from the study conducted in two mousers of Rajshahi city. The

spatial education mapping of the heads of the households has been planned in the article with the contribution of GPS, the location identifier of individual household. The study was used three methods data including direct observation, group discussion and household survey to collect the scarcity of household level published data. Some censuses basically household income and expenditure survey, Child Nutrition Survey (CNS), Census of 2001 and some GIS related publication of data are publicized on an irregular basis. A structured questionnaire survey was used to carry out the existing socio-economic and environmental dilemma of the study areas. Most of the spatial data is collected from RDA (Rajshahi Development Authority) office having the GIS based master plan of Rajshahi city and the spatial data including cadastral maps, land use, drainage, electricity line, water line and others was gathered from RDA. By studying Social problem, there faces a difficulty to cover the whole population in a single investigation as it is costly, time consuming, complex and financially not viable. Picking up a sample from the population is convenient. Overcoming the constraints of time and fund, the study was conducted into two mousers named Meherchandi and Keshubpur. The study areas were selected through purposive sampling in Rajshahi City Corporation comprising of thirty five wards. The two mousers from two different wards, the lowest administrative levels, were selected for exploration to discover the sample size 325 and its significance level at .05. Arc GIS, the most popular desktop GIS mapping software, was used to analyze the data. It provides data visualization, query, analysis, and integration capabilities along with the ability to create and edit geographic data. The creation of maps and tabular data can be done easily. However, from Arc View, the door of entering Arc GIS, to get the explanation despite having possibilities from Spatial Analyze is used for the investigation and other none-spatial software's including SPSS, Excel were needed to analyze.

Mapping

Many methods have been used to produce education mapping as the graphic steps are most commonly used method to produce maps in the palmy days of 21st technological era. Analyzing the pros and cons of mapping, generally eight generic steps involved for scarcity mapping are scot free by the by in a workout. The techniques of scarcity mapping introduced by Davis in 2002 were taken the fancies of producing the education mapping. Three R's in spatial representation of human wellbeing indicators were presented in his maps. Mapping, an important tool for the integrated investigation and decision

making of social, economic, and environmental problems, was known from the famous scientists, Henninger and Snel in 2002. The process, knowing the education level of the heads of the households, was mapped for representing their education under lock and key of the mapping by Henninger and Snel.

5. Results and Discussion

Profile of individual education

Skilful educated human resource, the key to development of a country [5] creates job facilities that make income opportunities [6]. That is why educational attainment is important to make a country through and through economically independent [7]. Bangladesh government provides stipend, scholarship, free studentship, and financial assistance for purchasing books as well as paying fees for examination for female students from primary to tertiary level of education, a very good initiative for empowering the women. Currently the knowledge of ICT (Information and Communication Technology) among the students from primary to secondary level has been increasing by leaps and bounds. Bangladesh government has been facilitating the blooming roses of educational institutions including primary, secondary and higher secondary education levels by providing free laptops with internet among 23000 students. Publishing the final examination results of all levels of education through internet, the slandered level of Bangladeshi education has reached in the epidemic proportion of apex.

In the figure 1, it helps to know about the enrolment of the student in the primary level is the 120.5 percent including 66.6% male and 53.9% female in 1990 whereas after 21 years the percentage jump up to 184.32 including 91.39% male and 92.93% female student in 2011 [5,6,7]. Through the contribution of globalization and the era of modernization and the post modernization, Higher education has become the individual's way of knowledge based economy not only in many Asia countries but the world. For being the birds of same feather of the advanced technological countries, Bangladesh government has taken many initiatives to make education compulsory for certain levels for both male and female children including some of the free education for both male and female and only female in some specific aspects by providing extra facilities in the educational institutions like the like the free distribution of books for primary level, some scholarships for both male and female and some of their educational costs and others. For the fulfillment of the Millennium Development Goals, Government of Bangladesh provides the highest allocation in the national budget for education which can contribute

to build up the greeks and latins of the human resources and prospects of development and so more than 20 percent of the total budget is distributed for the human development and education system of Bangladesh including the primary (Grade 1 to 5), secondary (grade 6 to 12) and higher secondary. Primary level education has two major institutional arrangements which are named as general education and madrasa education.

Secondary education is divided into three major streams including the general education, technical-vocational and madrasa education has been taken as a great concern for the prophets of development by the government of Bangladesh. By neck and neck with secondary education, Higher education is running on the basis of the general stream including inclusive of pure and applied science, arts, business and social science, madrasa and technical education which influences agriculture, engineering, medical, textile, leather technology and ICT tooth and nail. Madrasa, functional parallel to the three major stages of the general education, has similar core courses as in the general streams of primary, secondary and postsecondary level of education. But has additional emphasis on religious studies like the Quran and Hadith along with some of the Arabic books of Arabic literature and Arabic medium Islam-based education. The system is supervised by the Madrasa Board of the country [8].

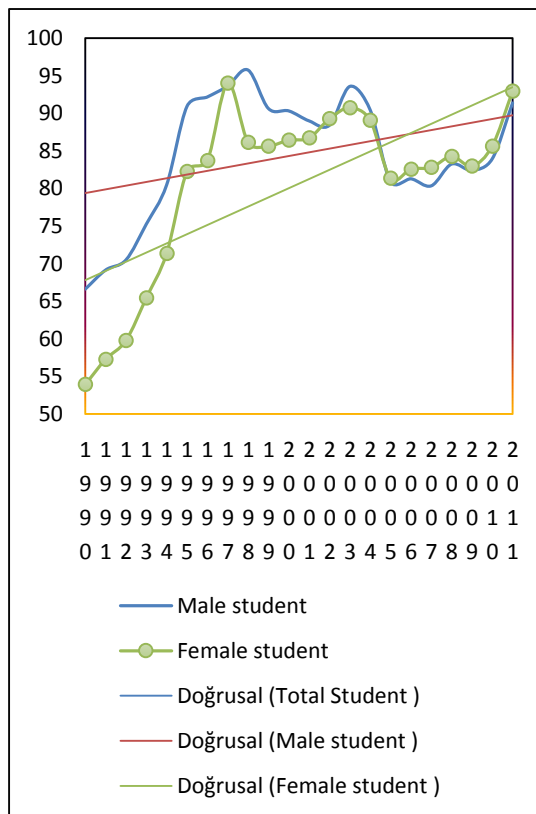
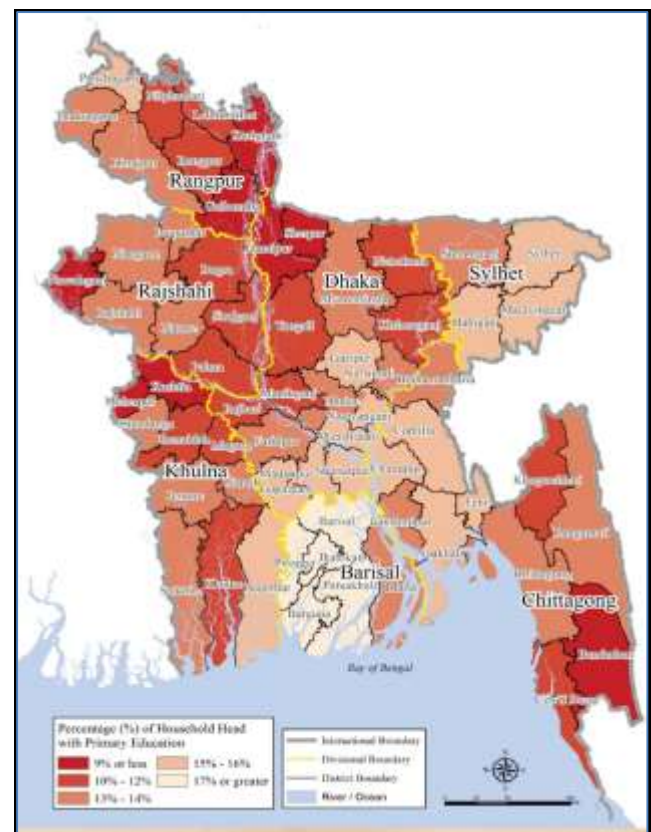


Figure 1 Enrolment Rate of Boys and Girls at Primary Level (1989-2011)

Rajshahi is the heart metropolitan city of ancient varendra of northern Bangladesh. Since 1971, the rate of urbanization of the city has increased in the city though the city was a simple district town only until 1947. It has become a divisional headquarters by the time of 1947 and in 1876 it also gained municipal status. From the status the city jumped up to City Corporation in 1987. From the figure 2, the household head, earning one and managing one of the families are shown as the completed level of their primary education level of Bangladesh of 2011. In some districts basically Nawabganj, Serarajgonj, Nilphamari Pabna and so on only lead to the the population of primary level education less than nine percent than the population of the head of household in North western Bangladesh. According to the above map Rajshahi City Corporation belongs to 10-12 percent primary completed level population. The cause of selecting Rajshahi City Corporation for study other than the lowest education level areas or districts is the limitation of the micro level data. Rajshahi City Corporation is called the city of education for having many renewed educational institutions. According to 1991 census, the literacy rate was only 30.51 percent while it was only 22.30 percent in 1981. RDA consultant surveyed household level and found that education rate is 90.52 percent.



Source: World Bank, BBS and WFO 2010.

Figure 2 Household Head Completed Primary Education.

Education Mapping

Education, a fundamental element of development, creates a better standard of living as well as the pioneers of the path maker for poverty reduction by dent of female education and women empowerment of both core and peripheral areas of not only a country but also the world [9]. By educating our girl children from toddler to younger, we can turn our women considered as the burden members of our society in to an empowered female resource, income earners for household, community, country and finally for the world [10]. The higher rate of absence from school is found among the children coming from the poorer families of the study areas and one of the causes behind that is the dependency of the families for their livelihood on their children for income. The students from the poorer community are usually found as the school droppers at a early level of their educational career as the thought leads to do so because they thing that Sending their children's is the waste of both time and wealth. Otherwise if they are not sent in the school by the time and their ability they should help to support in their family income and this way can help families to come out from the poverty circle. But unfortunately this is a false concept consciousness as not sending their children to school includes them into the poverty circle. It is a standard practice of the poorer society that their children are in the work and they don't feel necessary to send their children to school when schooling is free in the primary education in Bangladesh. In the study area Meherchandi, The Table 1 shows the educational information of the head of the household collected from the selected areas and the percentage of the educational level is 18 who had no education as they cannot sign their own name.

Table 1 Education level of the head of households (HH)

Education Level	Mouza				Total	
	Meherchandi		Keshubpur		N	F (%)
	N	F (%)	N	F (%)		
Illiterate	14	18.00	18	11.90	32	09.80
Primary	66	37.90	28	18.50	94	28.90
Junior high School	20	11.50	34	22.50	54	16.60
High School	56	32.20	36	23.80	92	28.30
College	14	08.00	34	22.50	48	14.80
Master Or	04	02.30	01	00.70	05	01.50

Above						
Total	174	100.00	151	100.00	325	100

Source: Field Survey, 2023. (n= number, f= frequency)

The illiterate people migrated from rural poverty-stricken area live in vulnerable places like nearby road or rail lines. The spatial distribution of education of the head of household is shown in the figure one. Where the 38% of the population has completed only primary schooling as to contribute the poor families, they had to drop out from school to work for income generation. Education level of second study area named Keshubpur is better than Meherchandi mouza (refer to Table 1). At this mouza, the higher educated people are more than Meherchandi areas. The table 1 shows the education levels of the urban poor of the study areas. The result of collected information shows the poorest level of completed primary education as around 30% of the population completed secondary school at Meherchandi and 38% at Keshubpur.

Limited resources, lack of education, vocational and political factors along with others lead to the factors of poverty. Many factors are responsible for the urban poverty. The fundamental factors, which are found in the study areas, include overpopulation with limited resources, location factor, lack of education, political causes of poverty, inadequate social services, environmental degradation as well as disaster. However, education is an essential element for development. Hand in hand with economic development, it creates a better standard of living and reduces development. In the explored areas, it is found through the group discussion that in the poor families, the number of outgoing school children is increasing day by day. The low levels of school attendance are often the result from the poor families relying on children labor. Almost 10% of total populations are illiterate here.

Percentage of education level of different income groups:

In the study, 6 groups are classified the respondents on the basis of Very poor to rich. The Table 2 (a) and Table 2 (b) shows the percentage of the income by the respondents coming from poor as lower middle class on the basis of illiterate, primary, Junior High School. The research shows that the only 50 % children of poor people complete their primary education. Only that graduated students are found in the upper middle class and rich Groups. The same result was found in the other studies of mouza keshubpur. Steps of Logistic regression method were used to find out the most influential variable of poverty. Both the univariate and multivariate Logistic regression are included to find out

analyze the result. Various levels of education including primary middle class college university are found that they are strongly associated with the level of poverty. Regarding to the education, the poor are highly affected by socio economic conditions to get education. Relative to those educational level it is found that illiterate, those up to primary level, are almost respectively 52 and 23 times more likely ($P = .001, .001$) to the poor. Relative to those middle class and higher middle class are almost 9 and 3 times more likely respectively ($P = .001, .087$) to the poor. To find out the influential demographic independent variables, the multivariate logistic regression is exercised, where the poor is used as dependent inductor with the independent indicators of family members, marital status, education level, respondent character and age. The model shows the results of the forwards stepwise procedure, where all the non-statistically significant variables have removed one at a time [11].

Table 2: Education Level of the Poor and No-Poor Household.

(a) Very Poor, Poor and Lower Middle Class

Education Level	Group (%)					
	Very Poor		Poor		Lower Middle Class	
	M	K	M	K	M	K
Illiterate	28.60	11.10	50.00	61.10	21.40	27.80
Primary	04.50	07.10	51.50	42.90	42.40	42.90
Junior high School	00.00	00.00	30.00	38.20	65.00	50.00
High School	01.80	00.00	26.80	25.00	69.60	63.90
College	00.00	02.90	00.00	11.80	85.70	50.00
Master Or Above	00.00	00.00	25.00	00.00	00.00	00.00

(b) Very Poor, Poor and Lower Middle Class

Education Level	Group (%)					
	Upper Middle Class		Rich		Very Rich	
	M	K	M	K	M	K
Illiterate	00.00	00.00	00.00	00.00	00.00	00.00
Primary	01.50	07.10	00.00	00.00	00.00	00.00
Junior high School	05.00	08.80	00.00	02.90	00.00	00.00
High School	01.80	08.30	00.00	02.80	00.00	00.00

College	14.30	20.60	00.00	08.80	00.00	05.90
Master Or Above	25.00	00.00	25.00	00.00	25.00	100.00

Source: Field Survey, M= Meherchandi, K= Keshubpur

Figure 3(a) and 3(b) are individual mapping of education, based on geographical location of Meherchandi Mouza and Keshubpur Mouza in Bangladesh. Relative to those educational level it is found that illiterate, those up to primary level, are almost respectively 52 and 23 times more likely ($P = .001, .001$) to the poor. Relative to those middle class and higher middle class are almost 9 and 3 times more likely respectively ($P = .001, .087$) to the poor. To find out the influential demographic independent variables, the multivariate logistic regression is exercised, where the poor is used as dependent inductor with the independent indicators of family members, marital status, education level, respondent character and age. The model shows the results of the forwards stepwise procedure, where all the non-statistically significant variables have removed one at a time [11].

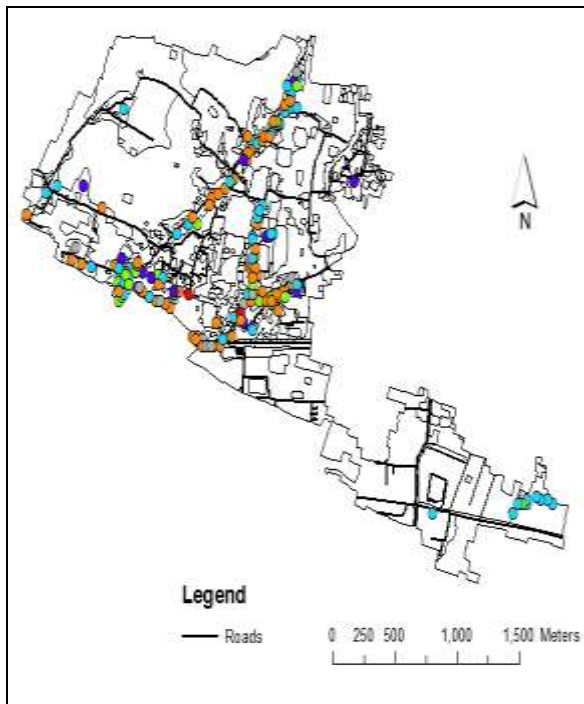
6. Conclusion

The spatial study of education, one of the human development indicators outranged from Human Development Index (HDI), Gender Development Index (GDI) and Human Poverty Index (HPI) of United Nation is the identifier of the individual level of education and the vital tool to identify disparities at individual level by the special analysis [12]. Special mapping of education based on education, gender, development and poverty along with regions must have assistance with the policy makers direct the right decisions and by the virtue of the right decisiveness, resource production, resource allocation and resource distribution can be provided easily instead of having critical planning appearances of the up to date circumstances not only nationally but also internationally. A bit of study on policy modelling summons for human enrolment, development and empowerment would be defective without the endowment of the spatial representation of individual education

(a) Meherchandi Mouza

Author Statements

- **Ethical approval:** The conducted research is not related to either human or animal use.



(b) Keshubpur Mouza

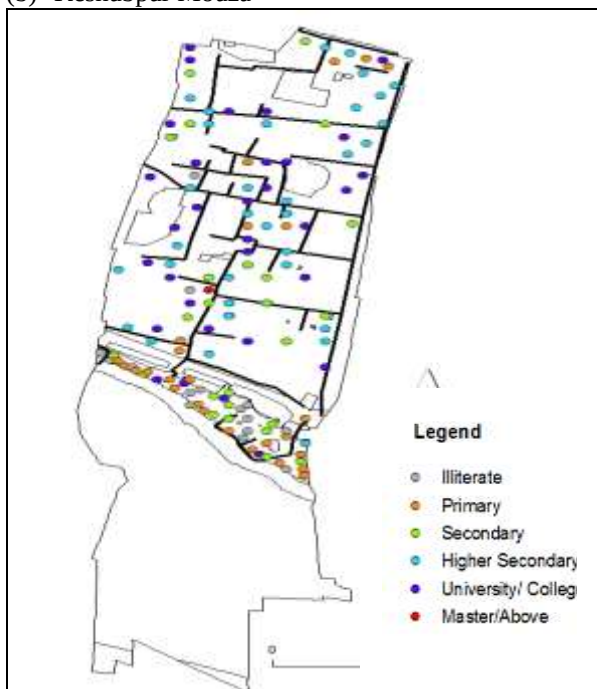


Figure 3: Individual education mapping of the head of household.

- **Conflict of interest:** The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper
- **Acknowledgement:** The authors declare that they have nobody or no-company to acknowledge.
- **Author contributions:** The authors declare that they have equal right on this paper.

- **Funding information:** The authors declare that there is no funding to be acknowledged.
- **Data availability statement:** The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

References

- [1] Sudipta R., Samia H., & Aisha, A.R., (2020). Faith and education in Bangladesh: A review of the contemporary landscape and challenges. *International Journal of Educational Development*, 79, November 2020.
- [2] Grissmer D, & Flanagan A. 2002. The role of federal resources in closing the achievement gaps of minority and disadvantaged children. In *Bridging the Achievement Gap*, ed. T Loveless. Washington, DC: Brook. Inst. Press.
- [3] Md. Ashfikur Rahman, Bayezid Khan, & Md. Hasan Howlader (2018). Secondary Education in Bangladesh: Issues and Challenges. *Int. J. Bus. Soc. Sci. Res.* 6(2): 19-25. Retrieve from <http://www.ijbssr.com/currentissueview/14013251>
- [4] Gwo-Jen, Hwang, Hui-chun Chu, and Yi-Kong Liang (2012) effects of an integrated concept mapping and web-based problem-solving approach on students learning achievement perception and cognitive loads 12th IEEE international conference on advance learning technologies.
- [5] GOB (2016), Bangladesh Economic Review 2016, Ministry of Finance Government of the People's Republic of Bangladesh November 2016
- [6] BBS, World Bank. WFP (2005) Updating Poverty Maps of Bangladesh 2010, Dhaka, Bangladesh.
- [7] BBS (2017) Education Scenario in Bangladesh: Gender Perspective, BBS, UCEP, Bangladesh
- [8] World Bank. BBS and WFP (2010) Poverty Maps of Bangladesh 2010, Dhaka, Bangladesh.
- [9] Bandura, Albert (1982)."Self-efficacy mechanism in human agency". *American Psychologist*. 37 (2): 122–147. doi:10.1037/0003-066X.37.2.122
- [10] Davis, B. (2002). "Is it Possible to Avoid a Lemon? Reflections on Choosing a Poverty Mapping Method." Mimeo, Draft, January 30, 2002. Food and Agriculture Organization of the United Nations.
- [11] Henninger. N & Snel. M. (2002). Where are the Poor? Experiences with the Development and Use of Poverty Maps. World Resources Institute, Washington, DC and UNEP/GRID-Arundel, Norway.
- [12] Katagall, R. Dadde, R. Goudar, R H and Rao, S (2015) concept mapping in education and semantic knowledge representation: an illustrative survey. *Procedia Computer Science*. 48(2015) 638-643.